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## PATENT COOPERATION TREATY

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PCT

NOTIFICATION CONCERNING  
SUBMISSION OR TRANSMITTAL  
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

KARAGHIOSSOFF, Giorgio, A.  
Karaghiosoff & Frizzi S.a.s.  
Via Pecorile, 27/B  
I-17015 Celle Ligure  
ITALIE

Date of mailing (day/month/year) 07 March 2000 (07.03.00)	
Applicant's or agent's file reference SV98A47-GIUF	<b>IMPORTANT NOTIFICATION</b>
International application No. PCT/EP99/05751	International filing date (day/month/year) 09 August 1999 (09.08.99)
International publication date (day/month/year) 02 March 2000 (02.03.00)	Priority date (day/month/year) 20 August 1998 (20.08.98)
Applicant GIUFFRE', Carmelo	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(\*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
20 Augu 1998 (20.08.98)	SV98A000047	IT	20 Dece 1999 (20.12.99)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No. (41-22) 740.14.35	Authorized officer  Marie-José Devillard  Telephone No. (41-22) 338.83.38.
--	--

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
 United States Patent and Trademark  
 Office  
 Box PCT  
 Washington, D.C. 20231  
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

<b>Date of mailing (day/month/year)</b> 06 April 2000 (06.04.00)	
<b>International application No.</b> PCT/EP99/05751	<b>Applicant's or agent's file reference</b> SV98A47-GIUF
<b>International filing date (day/month/year)</b> 09 August 1999 (09.08.99)	<b>Priority date (day/month/year)</b> 20 August 1998 (20.08.98)
<b>Applicant</b> GIUFFRE', Carmelo	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

02 March 2000 (02.03.00)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

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The International Bureau of WIPO  
 34, chemin des Colombettes  
 1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

C. Villet

Telephone No.: (41-22) 338.83.38

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>SV98A47-GIUF</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/EP 99/ 05751</b>	International filing date (day/month/year) <b>09/08/1999</b>	(Earliest) Priority Date (day/month/year) <b>20/08/1998</b>
Applicant <b>GIUFFRE', Carmelo</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

1



None of the figures.

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/EP 99/ 05751

## Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

The invention relates to a method for fabricating a drip irrigation pipe, comprising a pipe (5) wherein a plurality of dripping elements (4) are bound, communicating with the outside through holes formed in the pipe wall. The method according to the invention provides that the pipe (5) is extruded and the individual dripping elements (4) are bound therein by consecutively feeding the dripping elements (4) inside the pipe through the extruding head (1). The speed of the dripping elements (4) is higher than that of the pipe upon extrusion at least in the area of first contact between the pipe and the dripping elements (4). The invention also relates to a plant for implementing said method.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 99/05751

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 A01G25/02 B29C47/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A01G B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	EP 0 872 172 A (SWISSCAB S A) 21 October 1998 (1998-10-21) column 7, line 37 - line 46; claim 1; figure 7	1, 2
X	EP 0 344 605 A (HYDRO PLAN ENG LTD) 6 December 1989 (1989-12-06) abstract column 6, line 20 - column 7, line 25 claims 1, 3-10; figures	1, 2, 24
Y		3-8, 25, 26
A		9-11, 16, 20-23, 29, 36, 37, 39, 40
	---	
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

16 December 1999

Date of mailing of the international search report

22/12/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer

Jensen, K

## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/EP 99/05751

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 271 786 A (GORNEY MOSHE ET AL) 21 December 1993 (1993-12-21) column 6, line 57 -column 7, line 52 column 8, line 61 -column 9, line 17 column 10, line 21 - line 33	3-8, 25, 26
A	----- WO 92 05689 A (DERMITZAKIS EMMANUIL) 16 April 1992 (1992-04-16) page 13, line 1 - line 27; figures 26-30 -----	11-16, 18-24, 26, 32-41
A	US 5 324 371 A (MEHOUDAR RAPHAEL) 28 June 1994 (1994-06-28) abstract column 3, line 52 - line 59 column 4, line 19 - line 51 -----	1-4, 25
A		1-41

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 99/05751

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0872172	A	21-10-1998	AU 6194598 A	22-10-1998
			CN 1200325 A	02-12-1998
EP 0344605	A	06-12-1989	IL 86549 A	15-04-1991
			AT 86175 T	15-03-1993
			AU 620617 B	20-02-1992
			AU 3529289 A	30-11-1989
			BG 50042 A	15-04-1992
			CA 1314132 A	09-03-1993
			GR 91300085 T	10-12-1991
			GR 3007222 T	30-07-1993
			JP 1967410 C	18-09-1995
			JP 2238919 A	21-09-1990
			JP 6098667 B	07-12-1994
			KR 9407857 B	26-08-1994
			MX 170135 B	09-08-1993
			NZ 229332 A	26-09-1990
			PT 90684 A,B	30-11-1989
			RU 2062234 C	20-06-1996
			US 5324371 A	28-06-1994
			US 5022940 A	11-06-1991
			US 5122044 A	16-06-1992
US 5271786	A	21-12-1993	IL 95972 A	15-03-1993
			AT 152663 T	15-05-1997
			AU 648827 B	05-05-1994
			AU 8556091 A	16-04-1992
			CA 2053367 A	13-04-1992
			DE 69125996 D	12-06-1997
			DE 69125996 T	21-08-1997
			EP 0480632 A	15-04-1992
			ES 2103782 T	01-10-1997
			GR 92300060 T	31-08-1992
			GR 3024380 T	28-11-1997
			MX 9101520 A	05-06-1992
			PT 99191 A	29-10-1993
WO 9205689	A	16-04-1992	GR 90100727 A	25-09-1992
			AU 8738591 A	28-04-1992
			EP 0510135 A	28-10-1992
			US 5676897 A	14-10-1997
			ZA 9107913 A	31-03-1993
US 5324371	A	28-06-1994	IL 86549 A	15-04-1991
			AT 86175 T	15-03-1993
			AU 620617 B	20-02-1992
			AU 3529289 A	30-11-1989
			BG 50042 A	15-04-1992
			CA 1314132 A	09-03-1993
			EP 0344605 A	06-12-1989
			GR 91300085 T	10-12-1991
			GR 3007222 T	30-07-1993
			JP 1967410 C	18-09-1995
			JP 2238919 A	21-09-1990
			JP 6098667 B	07-12-1994
			KR 9407857 B	26-08-1994
			MX 170135 B	09-08-1993
			NZ 229332 A	26-09-1990



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No



PCT/EP 99/05751

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5324371 A		PT 90684 A,B	30-11-1989
		RU 2062234 C	20-06-1996
		US 5022940 A	11-06-1991
		US 5122044 A	16-06-1992
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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

15

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference SV98A47-GIUF	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP99/05751	International filing date (day/month/year) 09/08/1999	Priority date (day/month/year) 20/08/1998
International Patent Classification (IPC) or national classification and IPC A01G25/02		
Applicant GIUFFRE'CARMELO		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 3 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"><li>I <input checked="" type="checkbox"/> Basis of the report</li><li>II <input type="checkbox"/> Priority</li><li>III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li><li>IV <input type="checkbox"/> Lack of unity of invention</li><li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li><li>VI <input type="checkbox"/> Certain documents cited</li><li>VII <input checked="" type="checkbox"/> Certain defects in the international application</li><li>VIII <input checked="" type="checkbox"/> Certain observations on the international application</li></ul>		
Date of submission of the demand 02/03/2000	Date of completion of this report 05.12.00	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Fritsch, K Telephone No. +49 89 2399 7318 	

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP99/05751

## I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

**Description, pages:**

1-20 as originally filed

**Claims, No.:**

1-23,24 (part),28 (part), as originally filed  
29,30,35 (part),  
36-41

24 (part),25-27, as received on 21/07/2000 with letter of 18/07/2000  
28 (part),31-34,  
35 (part)

**Drawings, sheets:**

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/EP99/05751

listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description,      pages:
- ☐ the claims,      Nos.:
- ☐ the drawings,      sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

- ☐ the entire international application.
- ☒ claims Nos. 41.

because:

- ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):
- ☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 41 are so unclear that no meaningful opinion could be formed (*specify*):  
**see separate sheet**
- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.
- ☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination report cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

- ☐ the written form has not been furnished or does not comply with the standard.
- ☐ the computer readable form has not been furnished or does not comply with the standard.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/EP99/05751

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims 1 - 40
	No: Claims
Inventive step (IS)	Yes: Claims 1 - 40
	No: Claims
Industrial applicability (IA)	Yes: Claims 1 - 40
	No: Claims

**2. Citations and explanations  
see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/EP99/05751

**Section III:**

1. Claim 41 contains a reference to the description and the drawings. According to Rule 6.2(a) PCT, claims should not contain such references except where absolutely necessary, which is not the case here.

**Section V:**

1. Reference is made to the following documents:

D1: EP-A-0 872 172

D2: EP-A-0 344 605

D3: US-A-5 271 786

2. Document D1, which is considered to represent the most relevant state of the art, discloses (cf. Fig. 3b and 7) a method for fabricating drip irrigation pipes disclosing all the features of the preamble of claim 1.

The subject-matter of claim 1, therefore differs from this known Document D1 in that at least before the contact between the pipe and each dripping element occurs, the dripping element has a higher speed than the pipe.

In document D1 (column 7, line 42 - 44) the dripping element has the same speed as the pipe.

The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).

As this characterising feature is also not disclosed in the available documents of the prior art, the subject-matter of claim 1 involves an inventive step. (Article 33(3) PCT).

Documents D2 and D3 also disclose all the features of the preamble of claim 1, but the dripping element has the same speed as the pipe in document D2 (column 6, line 20 - 37) and a lower speed in document D3 (column 6, line 67 - column 7, line 1).

3. Claims 2 - 23 are dependent on claim 1 and as such also meet the requirements

of the PCT with respect to novelty and inventive step.

4. Document D1, which is considered to represent the most relevant state of the art, discloses (cf. Fig. 7) a plant comprising:
- a) means (36) for extruding a plastic pipe (37) through an extruding head (40)
  - b) calibrating means (38)
  - c) feeding means (44, 45) for inserting consecutively a plurality of dripping elements (4), and keeping pace with the advance of the extruded pipe (37), through the extruding head (40) into the extruded pipe (37)
  - d) Conveying and dragging means (44, 45, 16a) for feeding each dripping element (4) to the area of the pipe whereat each dripping element (4) is brought to contact with a predetermined area of the inner surface of the pipe (37), while having a predetermined speed with the respect to the speed of the pipe (37) when contact occurs.

from which the subject-matter of claim 24 differs in that

- (i) Conveying and/or pushing and/or dragging means for feeding each dripping element are driven in such a way that the speed of the dripping elements upon impact with the pipe is higher than that of the pipe

The subject-matter of claim 24 is therefore as far as it is understandable (see Section VIII) novel (Article 33(2) PCT).

As feature (i) is also not disclosed in the available documents of the prior art, the subject-matter of claim 4 involves an inventive step. (Article 33(3) PCT).

5. Claims 25 - 40 are dependent on claim 24 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

#### **Section VII:**

1. Independent claim 24 is not in the two-part form in accordance with Rule 6.3(b)

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

---

International application No. PCT/EP99/05751

PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

**Section VIII:**

1. It is clear from the description and drawings, that the dragging means of claim 24 is in fact comprised by the conveying means and the inner surface of the pipe. Claim 24 is therefore not clear as required by Article 6 PCT.



with the advance of the extruded pipe (5), through the extruding head (1) and into the extruded pipe (5);

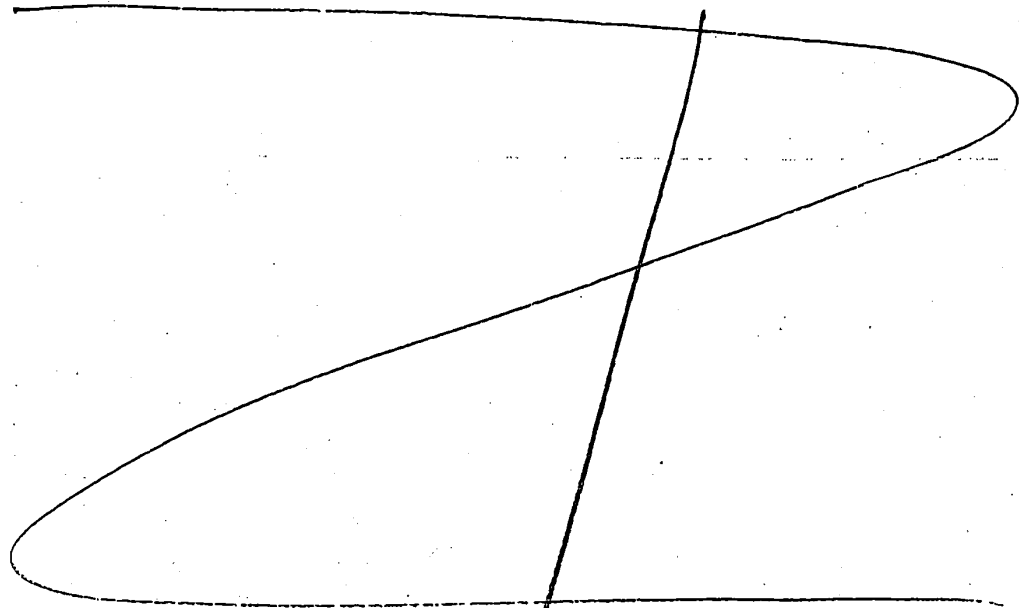
5 d) Conveying and/or pushing and/or dragging means (103, 11) for feeding each dripping element (4) to the area of the pipe whereat each dripping element (4) is brought to contact with a predetermined area of the inner surface of the pipe (5), while having a predetermined speed with respect to the speed of the  
10 pipe (5) when contact occurs;

e) The Conveying and/or pushing and/or dragging means (103, 11) for feeding each dripping element (4) are driven in such a way that the speed of the dripping elements upon impact with the pipe (5) is higher  
15 than that of the pipe (5).

*Do not enter*

5

10



25. A plant as claimed in claim 24, characterized in  
15 that the means for advancing, dragging and/or pushing  
the dripping elements (4) are driven in such a way as  
to cause an impact of the dripping elements against the  
pipe which is meant to impress a mark in the contact  
area of the inner surface of the pipe (5).

20 26. A plant as claimed in claims 24 or 25,  
characterized in that it comprises means (3) for  
guiding the dripping elements (4), consisting of a  
stationary slide surface.

25 27. A plant as claimed in claims 24 or 25,  
characterized in that it comprises means (3, 103) for  
guiding the dripping elements (4), consisting of  
surfaces which are passively moved together with said  
dripping elements (4) or of rolling surfaces.

28. A plant as claimed in claims 24 or 25,  
30 characterized in that the guide means (3, 103) act, at

31. A plant as claimed in claim 30, characterized in that the disengagement is obtained thanks to elastic means for damping the force for dragging, advancing and/or pushing the dripping elements (4) or thanks to  
5 friction means.

32. A plant as claimed in one or more of the preceding claims 24 to 31, characterized in that, in the area situated downstream from the first contact between the dripping elements (4) and the pipe (5),  
10 there are provided presser means (11, 11', 11"), outside the pipe (5), which are stressed by an adjustable compression force having at least one component perpendicular to the wall of the pipe (5).

33. A plant as claimed ~~in one or more of the~~  
15 ~~preceding claims 24 to 32~~, characterized in that the pressure means consist of a stationary presser means (11), i.e. a means at least having surfaces of contact with the pipe (5) which are stationary with respect to the advance motion of the pipe (5).

20 34. A plant as claimed ~~in one or more of the~~  
~~preceding claims 24 to 32~~, characterized in that the presser means have a contact surface which passively accompanies the advance motion of the pipe (5), or a surface which is meant to roll thereon.

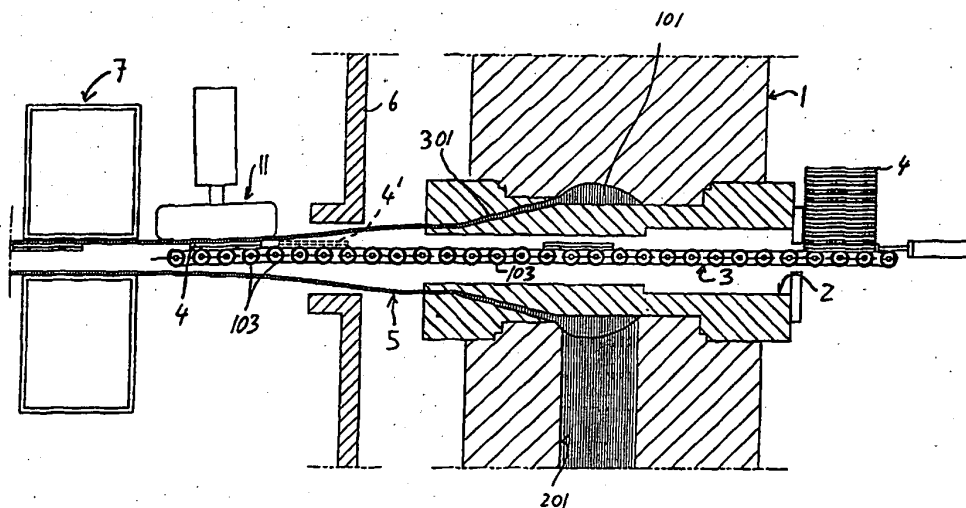
25 35. A plant as claimed in one or more of the preceding claims 24 to 32, characterized in that the presser means have one surface of contact with the pipe (5) which is driven by its own motion in the advance direction of the pipe (5), and which exerts a pushing  
30 and/or dragging action on the pipe (5) in the advance



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(54) Title: METHOD AND PLANT FOR FABRICATING DRIP IRRIGATION PIPES



## (57) Abstract

The invention relates to a method for fabricating a drip irrigation pipe, comprising a pipe (5) wherein a plurality of dripping elements (4) are bound, communicating with the outside through holes formed in the pipe wall. The method according to the invention provides that the pipe (5) is extruded and the individual dripping elements (4) are bound therein by consecutively feeding the dripping elements (4) inside the pipe through the extruding head (1). The speed of the dripping elements (4) is higher than that of the pipe upon extrusion at least in the area of first contact between the pipe and the dripping elements (4). The invention also relates to a plant for implementing said method.

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## Method and plant for fabricating drip irrigation pipes

The invention relates to a method for fabricating  
5 drip irrigation pipes, or similar, comprising the following steps:

- a) Extruding a plastic pipe through an extruding head;
- b) Progressively reducing the pipe, from the diameter coming out of the extruding head to a final diameter  
10 which provides the extruded pipe with a conical shape for a certain initial length.
- c) Inserting a plurality of dripping elements consecutively and keeping pace with the advance of the extruded pipe, through the extruding head and  
15 into the extruded pipe;
- d) Advancing each dripping element to an area of the pipe, whereat each dripping element is brought to contact with a predetermined area of the inner surface of the pipe, while having a predetermined  
20 speed relative to the speed of the pipe when contact occurs;
- e) Cooling the pipe with the dripping elements;
- f) Perforating the pipe where the dripping elements are provided.

25 Some methods for fabricating drip irrigation pipes of the type described above are known from the state of the art.

All these methods aim at binding the dripping elements with a predetermined resistance, in order to  
30 prevent the detachment of the dripping elements. To

this end, substantially two methods have been developed. A first method provides that the dripping elements are deviated towards the pipe wall in the conical area, directly on exit from the extruding head and that, when the pipe and the emitting element are coupled, i.e. come to contact, the latter has a different speed, i.e. lower than that of the pipe. Further, downstream from the contact area, generally in a so-called subsequent calibrator, or even in the contact area itself, there are provided means for compressing the dripping elements against the pipe. Obviously, once the contact has occurred, the speeds of the pipe and of the dripping elements are the same.

This method is disclosed for example in document US 5,271,786. In this method, the dripper units are displaced on a guide which is provided coaxially inside the extruded conduit. The contact between the dripper unit and the internal surface of the conduit takes place in the region of a first step of reduction of the cross-section of the extruded conduit. In this document the dripper unit is displaced transversally in the direction of the conduit by means of a guide section which is inclined in a direction converging against the conduit wall. At the location of contact of the dripper unit with the conduit, the conduit wall being reduced to a lower diameter has a substantially conical orientation and converges against the inner guide for the dripper unit. In this situation the leading end of the dripper unit is raised against the conically reducing wall of the extruded conduit and hurts it with

a leading corner. This may lead to damage of the softened wall of the conduit.

A second method provides that the dripping elements are brought to contact with the pipe in an area in which the diameter of the latter has been reduced, that is downstream from the conical narrowed length. In this case, the emitting elements are advanced, at least in the area or location whereat they contact the pipe, at a speed which is substantially identical to that of the pipe itself. Once again, the contact is followed by a compression step. This method is disclosed in documents EP 344 605 and EP 872 172.

In both this documents, the orientation of the contact surfaces of the extruded conduit and of the dripper unit are convergent and such that the first contact takes place between the region of the corner of the leading head of the dripper and the inner surface of the extruded conduit.

In the first method, in order that the dripping elements are well fastened to the pipe, either long compression areas or considerable compression forces have to be provided. However, these dimensioning provisions are subject to substantial restrictions, due to the fact that the pipe must not be prevented from axially sliding, so that the correct formation of the pipe is not jeopardized. On the other hand, the second method requires a sufficiently accurate adjustment of the feed speed of the pipe and of the emitting elements, in order to ensure that the speeds of these two parts upon contact therebetween are substantially



the same. Also in this case, the path along which the pipe and the dripping elements are submitted to mutual compression must be sufficiently long, or the compression force must be sufficiently high, therefore  
5 involving the risk that the advance of the extruded pipe is obstructed or hindered.

In all the disclosed methods and devices, care is taken to the fact that at the moment of the contact between extruded conduit and dripper unit both have  
10 either the same speed or the dripper unit is at rest or has a lower speed than the conduit.

Furthermore after the first contact, the dripper unit is not any more pushed or drawn by dedicated means, but is dragged by the extruded conduit itself.

15 Both the above measures are intended to avoid the damaging of the conduit during the contact between dripper units and conduit and during welding of the dripper units to the conduit.

The invention has the object to provide a method for  
20 fabricating trickle irrigation pipes of the type described hereinbefore, allowing to obviate the drawbacks of the well-known methods, while simplifying or anyway exploiting as well as possible the conditions occurring in the initial zone downstream from the  
25 extruder.

The invention achieves the above objects by providing a method as described hereinbefore, in which at least immediately before the contact between the pipe and each dripping element occurs, the dripping  
30 element has a higher speed than the pipe.

Preferably the dripper units have an higher speed than the pipe also at the moment of contact the one against the other.

According to a preferred embodiment, the dripper  
5 units are dragged or pushed or displaced further also after being come into contact against the pipe and independently of the pipe itself.

The speed of the dripper units immediately before or at the moment of the contact against the pipe may be  
10 higher than the pipe speed by an amount of 5% to 300%, preferably 10% to 150%, particularly 20% to 100%.

Thanks to this provision, a certain amount of the kinetic energy applied to the emitting elements is transferred into a compression impulse of the emitters  
15 against the inner surface of the pipe. The inertial motion of the dripping elements causes them to hit the inner surface of the pipe with a certain force. The transverse component of the force may be more or less considerable, from a minimum value in which there is a  
20 sort of tangential force generating a sort of impact mark impressed by the dripping elements in the contact area, also due to the relatively softened condition of the pipe, to a higher value, in which, in addition to the substantially tangential impact mark, there is also  
25 an axial impact compression force, exerted by the dripping element against the surface of the pipe.

The above substantially depends on the extension of the area of contact between the emitting elements and the pipe and/or on the orientation thereof.

30 The orientation of the dripping elements relative to

the pipe, i.e. of the mutual contact surfaces is determined by the length of the pipe whereat the pipe comes to contact with the dripping elements, and by the orientation imparted to them by the feed path inside  
5 the pipe.

Obviously, the individual dripping elements, having a higher speed than the pipe, must be fed while keeping pace with the advance of the extruded pipe, in such a way that the individual dripping elements are provided  
10 at the predetermined distance from each other on the finished pipe.

In this case, a continuous feed is possible, the individual dripping elements being spaced, along the feed path, to an extent corresponding to the area of  
15 contact with the pipe, i.e. the dripping elements being consecutively and continuously fed, the distance between immediately successive elements being greater than the final distance separating them when they are applied to the pipe, all this being in relation with  
20 the speed differences between the dripping elements and the extruded pipe.

Alternatively, the individual dripping elements may be fed in a reciprocating and stick-slip motion, for example by pushers operated in a reciprocating motion.

25 A first variant of this feeding method may provide a start station wherein the dripping elements are kept still or moved at a speed which is not higher than that of the pipe and wherefrom they are accelerated one at a time and each separately at the higher speed until the  
30 impact with the extruded pipe occurs.

In a variant embodiment, along the feed path inside the pipe and up to an external station, there is provided a continuous line of dripping elements in mutual contact at the end sides. In this case, at the rear side, with respect to the advance direction of the pipe, there are provided means for the reciprocating acceleration of the last forwardmost dripping element of the line, which operate on the first rearmost dripping element of the line.

10 In a preferred embodiment, the contact between the dripping elements and the inner surface of the pipe occurs in the conical narrowed length of the pipe. In these conditions, the kinetic energy of the dripping elements changes, at least partially, into a compression force perpendicular to the inner surface of the pipe. The axial component is not detrimental, since it helps to cause a certain wedging action of the dripping element in the material which forms the pipe wall.

20 Thanks to this arrangement, a higher impact force is generated, and a stronger link between the two parts is obtained. Moreover, the adjustment of the two speeds is not critical, the ratio between the speeds of the pipe and of the emitters not being critical and not requiring strict tolerances.

25 According to a further improvement of the method, in the contact area, the two surfaces, the inner surface of the pipe and the facing surface of the dripping elements are preferably oriented in such a way as to converge forming a predetermined angle which is very

small.

The angle between the two surfaces of contact of the dripper unit and of the pipe is of such entity that the surface of the dripper unit is slightly inclined with  
5 respect to an orientation which is substantially parallel to the associate surface of the pipe.

Thanks to this feature the dripper unit contacts the pipe wall in an very smooth way having a converging path but having at the same time a reduced angle of  
10 incidence and quite the same orientation as the conical reduction section of the pipe entering the calibrator section.

In a device according to the invention this feature is achieved by providing an end section of the dripper  
15 guide which extends itself in the region of the conical reduction in cross section of the pipe between extruder exit mouth and calibrator unit entrance and which end section is slightly inclined in the same way as the conical section of the pipe but with a smaller angle  
20 with respect of the axis of the pipe.

This features allows also to provide independent means for pushing, dragging or in any way further exerting a displacement force on the dripper unit after having contacted the pipe without the risks of damaging  
25 the pipe and giving the opportunity of exerting a compression force of the dripper against the wall of the pipe after the first contact.

Advantages may be also obtained from providing, once the contact between the dripping elements and the pipe  
30 has occurred, a length of the path along which a mutual

compression force is exerted by the dripping elements and by the pipe.

To this end, the dripping elements move, integrally with the pipe, on an internal abutment guide, whereas  
5 outside the pipe, in a position opposite to the abutment guide, there is provided a presser member.

According to a further characteristic, the advancing and/or dragging and/or pushing action of the dripping elements inside the pipe continues even when the impact  
10 or contact thereof with the pipe has occurred, in the succeeding mutual compression area.

Advantageously, the advancing and/or dragging and/or pushing action of the dripping elements is exerted in such a way that the advancing force exerted on the  
15 dripping elements and therefore on the pipe is limited to a certain predetermined value, either in a sudden or in a progressive way.

According to the type of means for conveying, advancing, dragging, or pushing the dripping elements,  
20 the force for advancing them may be limited by a friction effect occurring between said means and the dripping elements or by elastic damping means.

Advantageously, the orientation of the dripping elements and of the pipe in the compression length is  
25 such that the two parts are parallel to each other, at least with respect to the contact surfaces.

Particularly, the compression length is provided in a further conical narrowed length of the pipe downstream from the area of contact between the  
30 dripping elements and the pipe.

The compressing means and/or the abutment means may be stationary, i.e. having surfaces of contact with the pipe and/or with the dripping elements, which are stationary with respect to the advance of said parts or  
5 having surfaces which are movable together with the pipe and/or with the dripping elements, or said means may be such that at least one of these means, or even both of them are driven by their own motion, dragging the pipe, together with the dripping elements, in the  
10 feed direction.

The dragging speed may be calibrated according to the best possible advance of the pipe.

This characteristic allows to adjust the advance speed of the pipe and keep it at optimum values, even  
15 in case of possible variations, due to compression forces exerted between the dripping element and the pipe.

In all three cases described above, the distance between the compression means outside the pipe and the  
20 means for abutment and/or guide of the dripping elements may be slightly smaller than the total thickness of the pipe wall and of the dripping elements.

The abutment means may advantageously consist of  
25 means for guiding the dripping elements and/or may even be the conveying, feeding and/or pushing means.

The invention also relates to a plant for implementing the method described hereinbefore, which plant comprises:

30 a) Means for extruding a plastic pipe, through an

extruding head;

- 5           b) Calibrating means for progressively reducing the pipe from the diameter coming out of the extruding head to a final diameter along which reduction, the extruded pipe has a conical length.
- 10           c) Feeding means for inserting consecutively a plurality of dripping elements, and keeping pace with the advance of the extruded pipe, through the extruding head and into the extruded pipe;
- 15           d) Conveying and/or pushing and/or dragging means for feeding each dripping element to the conical narrowed area of the pipe whereat each dripping element is brought to contact with a predetermined area of the inner surface of the pipe, while having a predetermined speed with respect to the speed of the pipe when contact occurs;
- 20           e) Compressing means extending for a certain feed length and meant to mutually compress the pipe and the dripping elements for completely binding the dripping element to the pipe.

25           According to the invention, the conveying and/or pushing and/or dragging means are operated in such a way that the individual dripping elements are accelerated inside the pipe at a speed which is higher than that of the pipe, in the area and at the moment in which the impact of the dripping elements against the pipe occurs.

30           The invention relates to further characteristics,



which will appear more clearly from the following description of a few non limiting application examples, shown in the accompanying drawings, in which:

Fig. 1 is a schematic axial sectional view of a first example of a plant for implementing the method according to the invention, showing the relevant area of the plant.

Fig. 2 is a view like that of fig. 1, partly enlarged and showing a variant embodiment.

Fig. 3 is a view like that of fig. 2, further enlarged and showing a further variant embodiment.

Fig. 4 is a view like those of the previous figures, showing a third embodiment.

Fig. 5 is a view like that of fig. 1, showing a variant embodiment, in which the compression means situated outside the pipe consist in the contact walls of a calibrator.

Referring to the figures, it has to be pointed out that any characteristics appearing together in each of them may be individually combined to each other in order to obtain further obvious and possible combinations, not shown in the figures.

A plant for fabricating trickle irrigation pipes by extrusion, such as that described in state of the art patents EP 0 344 605 and/or US 5,271,786, comprises an extruding head 1, having an annular chamber 101 and a radial conduct 201 for feeding plastic at the machinable state. The annular chamber 101 axially extends to an annular drawing conduct 301, whereof a continuous pipe comes out. In a coaxial position with

respect to the annular conduct 301 and to the annular chamber 101, the extruding head 1 has a central through hole 2, wherein means 3 are supported for guiding a succession of plastic dripping elements 4. The guide means 3 extend from an end whereat the dripping elements 4 are charged, which is outside the extruding head 1, opposite to the annular drawing aperture of the pipe 5, and continue beyond the extruding head at the output of said pipe 5, to an area in which the pipe passes through a calibrating reduction, from the diameter coming out of the drawing hole, to the substantially final diameter. In this reduction area, the pipe 5 has a conical profile. After a short free length, the pipe passes through a first wall 6, determining the first diameter reduction, and anyway acting as a container for cooling water. At a certain distance from this wall, in the advance direction of the pipe 5, there is provided a so-called calibrator 7, having an aperture for the passage of the pipe, which has a diameter for narrowing the pipe to the substantially final diameter or to a further intermediate diameter, a further calibrator being provided, in this case, downstream from said first one 7. As pointed out above, through all these passages, the pipe has a substantially constant or continuous conical profile, but not necessarily a constant aperture angle. The guide means 3 extend to the area intervening between said first wall 6 and the succeeding calibrator 7. Obviously, this is not to be intended in a restricted sense, since the guide means 3

may also extend further to the area intervening between the calibrator 7 and a further second calibrator.

The slide plane 103 for the guide means 3 is in such a position, with respect to the facing inner surface of the pipe 5, that said slide plane 103 converges with the conical inner surface of the pipe 5, forming a predetermined angle therewith, and causing, in a certain location, the contact between the dripping element 4, fed along said guide plane, and the pipe 5.

The contact area in the pipe may be located anywhere, and in the examples as shown in the figures, it is situated preferably, but not limited to, downstream from the first wall 6 for containing the cooling water, i.e. after the first conical free length of the pipe 5.

However, the contact may also occur upstream from the wall 6, i.e. in said conical free length, or even in the area of the calibrator 7, or downstream therefrom, between said calibrator 7 and a further possible calibrator (not shown).

Referring to the figures, the dripping elements 4 may be dragged, pushed, or advanced with the help of any type of means. The slide plane may be a simple guide surface, along which the dripping elements 4 slide thanks to an appropriate low-friction arrangement. Alternatively, the means for advancing the dripping elements 4 may consist of the guides 3, which are of the operating type, i.e. being able to convey or provided or made in the form of conveying means.

With particular reference to the figures, in the embodiment as shown therein, the guide means 3 are

provided in the form of a roller way. The rollers may be rotatably driven, in such a way as to feed the dripping elements 4 or, as shown in fig. 3, they may be idle, whereas pusher means are provided, for example a  
5 push-bar 10, which is driven by an axial reciprocating motion and consecutively pushes each dripping element 4 inside the pipe up to the area of contact therewith.

Obviously, many other solutions may be provided for feeding, dragging or advancing the dripping elements 4,  
10 So, for example, the guide means may consist of a very low friction guide, and the dripping elements 4 may be shot into the pipe 5, for example by compressed air, or the guide means substantially have the form of tubes, and the dripping elements are shot through said tubes.  
15 The roller way 103 may be also replaced by a conveyor belt, a blade drive belt, particularly of such a type as to be elastically compliant when a predetermined dragging force is exceeded or by other means equivalent thereto or having the same function.

20 The means for dragging, advancing, or feeding the dripping elements 4 are driven in such a way that the speed of the dripping elements 4, upon impact with the pipe 5 is higher than that of the pipe 5. In this way, the impact kinetic energy causes the dripping element  
25 to penetrate at least partially in the surface of contact with the pipe 5, thus impressing a sort of mark.

As shown in the figures, the means for dragging, pushing or advancing the dripping elements 4 may  
30 continue their action on the dripping elements 4 even

after the first impact with the pipe 5. In this case, since the speed of said advancing, dragging or pushing means is higher than that of the pipe 5, said means cause the dripping elements 4 to exert a certain compression action against the pipe 5, though avoiding to exert a braking action on the pipe 5.

The thrust exerted by driving the means for dragging, advancing or pushing the dripping elements 4 even after the contact of the latter with the pipe 5 has occurred, may be easily modulated or adjusted, by providing that the junction between said dragging, advancing or pushing means may be disengaged when the dripping element 4 reaches a certain resistance to advance. In this case, the rollers of the roller way 103 may be provided with a contact surface having a predetermined friction with respect to the bearing surface of the dripping elements 4, so that a friction effect of the dripping elements 4 on the rollers 103 is obtained. Alternatively, as shown in fig. 3, when a push-bar 10 is used, the latter may have a pushing head 110 which may be elastically retracted to a predetermined extent on the stem 210 and against the action of elastic means 310, which are appropriately dimensioned as regards their force or elastic constant.

The individual dripping elements may be advanced continuously, as shown in figures 1, 2, 4. Naturally, in this case, in order to ensure that the dripping elements have the correct relative distance in the finished condition of the pipe, the dripping elements must have, on the feeding path, a greater distance from

each other than the final distance separating them when they are fastened to the pipe, to an extent corresponding to the speed difference between the pipe and the dripping elements.

5       According to a further variant, shown in figs. 3 and 5, the dripping elements are fed in a stick-slip, i.e. reciprocating motion. In this case, the alternative feeding means may be provided like those shown in fig. 3, i.e. acting separately on each individual dripping  
10       element, in accelerating it from a start station until the impact against the pipe occurs. Obviously, the push-bar of fig. 3 is just an example of the possible different means for dragging, advancing, accelerating, and pushing the dripping elements.

15       Fig. 5 shows a further variant of the method for feeding the dripping elements. Here, the start station is provided in the area directly upstream from the area of contact between the pipe and the dripping element. On the path 3, whereon the dripping elements are fed  
20       into the pipe 5, there is provided a line of dripping elements all directly in contact with each other. Reciprocating pushing means 20 act on the first dripping element, the rearmost element of the line, with reference to the advance direction, and, all  
25       through the line, they accelerate at the predetermined impact speed the last forwardmost element of the line, which is in the aforesaid start station.

      In figures 1, 2, 3, 5, the numeral 4' indicates the dripping element in the condition of initial impact  
30       with the pipe 5, and said dripping element is outlined

by a dashed line.

As is apparent from the figures, according to a further improvement of the invention, downstream from the contact area, and preferably in the area wherein the action of the means for dragging, advancing or pushing the dripping elements 4 is still operating, presser means 11 are provided outside the pipe 5, which compress with a predetermined force the pipe 5 against the corresponding dripping element 4, borne by the guide means 3 and/or by the dragging, advancing or pushing means.

In the embodiment as shown in fig. 1, said means consist in a presser which is stationary with respect to the advance direction of the pipe, and is radially pushed against the pipe 5. The presser 11 is provided in the form of a pad made of a low friction material and its compression force may be adjusted, for example through adjustable elastic compression means, such as springs, or similar, or through pneumatic or hydraulic compression means, or the like.

Here, the additional thrust on the dripping elements 4 in this area compensates for any possible reduction in the advance speed of the pipe caused by the radial compression, which may involve a malformation of the pipe 5 itself.

Advantageously, the presser/s 11 may be also provided in such a way that they can passively accompany the pipe in its advance, as indicated by the wheel 11' in figures 2 and 3 or by the belt or tape 11" in fig. 4. Alternatively to the single wheel 11' and to

the tape or belt 11", a train of rollers may be also provided.

A further improvement provides that the presser means 11, 11', 11" , besides passively accompanying the pipe 5 in its advance, are driven by their own motion, at a predetermined speed, which substantially corresponds to the correct advance speed of the pipe at the location where said presser means 11, 11', 11" are provided.

By this arrangement, not only is the pipe prevented from slowing down but, thanks to the combined action of the presser means 11, 11', 11" and of the dragging, advancing and pushing means, the advance speed of the pipe may be adjusted accurately, allowing to compensate for any other speed deviations caused by other reasons.

With reference to the figures and particularly with reference to figure 3, according to a further improvement, the guide means 3, in the internal end region of the pipe 5, i.e. in the area corresponding to the possible external presser means 11, 11', 11", have such an orientation that the contact surface of the dripping elements 4 is parallel to the corresponding inner contact surface of the conical wall of the pipe 5. Moreover, the presser means 11, 11', 11" are also oriented accordingly and are loaded perpendicularly to said conical length of the pipe 5.

With reference to the variant embodiment of fig. 5, the presence of external presser means may be avoided, by using to this end the succeeding calibrator 7. In this case, after a conical free length of the pipe 5,



wherein the pipe and the dripping elements get in contact, the latter moving at a higher speed than the pipe, the pipe 5 enters the calibrator, which has an aperture, while the guide 3 extends therein. The wall  
5 of the aperture for letting the pipe 5 into the calibrator 7 acts in this case as a presser element.

Also in this further example, such a wall may be stationary, or may have, in the area of contact with the pipe length wherein the dripping element is  
10 provided, contact surfaces which may be moved either passively, i.e. being idle, or actively, i.e. being motor-driven, such as a wheel, a roller, or similar.

Naturally the invention is not limited to what has been described and illustrated herein, but may be  
15 greatly varied, especially as regards construction, without departure from the guiding principle disclosed above and claimed below.

CLAIMS

1. A method for fabricating drip irrigation pipes, or similar, comprising the following steps:

- 5 a) Extruding a plastic pipe (5) through an extruding head (1);
- b) Progressively reducing the pipe (5), from the diameter coming out of the extruding head to a final diameter, during which reduction the extruded pipe (5) has a conical length.
- 10 c) Inserting a plurality of dripping elements (4) consecutively and keeping pace with the advance of the extruded pipe, through the extruding head (1) and into the extruded pipe (5);
- d) Advancing each dripping element (4) to an area of  
15 the pipe (5), whereat each dripping element (4) is brought to contact with a predetermined area of the inner surface of the pipe (5), while having a predetermined speed relative to the speed of the pipe when contact occurs;
- 20 e) Cooling the pipe (5) with the dripping elements;
- f) Perforating the pipe (5) where the dripping elements (4) are provided.

Characterized in that

- g) at least before the contact between the pipe (5) and  
25 each dripping element (4) occurs, the dripping element (4) has a higher speed than the pipe (5).

2. A method as claimed in claim 1, characterized in that the speed of the dripping elements (4) is higher than that of the pipe (5), at least immediately before  
30 the contact with the pipe (5) occurs and until the

dripping element (4) hits the wall of the pipe (5).

3. A method as claimed in claims 1 or 2, characterized in that the mutual orientation of the inner surface of the pipe (5) and of the facing contact surface of the dripping elements (4) in the area or moment of contact may be chosen in such a way as to vary at will, within certain limits, the transverse component of the force, i.e. the one directed radially towards the pipe (5) when the dripping elements (4) hit the pipe (5).

4. A method as claimed in one or more of the preceding claims, characterized in that the higher speed of the dripping elements (4) when they hit the inner surface of the pipe (5) is such as to generate an impact mark in the inner surface of the pipe (5), which may also be a sort of wedging mark.

5. A method as claimed in one or more of the preceding claims, characterized in that the contact between the dripping elements and the inner surface of the pipe occurs in the conical narrowed length of the pipe, the path of the dripping elements (4) converging at least on one side towards the conical wall of the pipe (5).

6. A method as claimed in one or more of the preceding claims, characterized in that after the first contact between the dripping elements (4) and the pipe (5) has occurred, a path length is provided, wherein a mutual compression force is exerted by the dripping elements (4) and by the pipe (5).

7. A method as claimed in claim 6, characterized in

that the compression force is exerted while continuing to advance, drag and/or push the dripping elements (4) with the same force or at the same conditions as those provided before contact with the pipe (5).

5        8. A method as claimed in claim 7, characterized in that the force wherewith and the conditions whereat the dripping elements (4) are dragged, advanced and/or pushed during the further action exerted once the contact with the pipe (5) has occurred, are limited  
10 with respect to the dragging, advancing and/or pushing force and conditions before contact with the pipe (5).

9. A method as claimed in claim 8, characterized in that the dripping elements (4) are pushed, whereas the thrust limitation after contact takes place  
15 progressively, by means of elastic dampers.

10. A method as claimed in claim 8, characterized in that the dripping elements (4) are joined by friction means, to dragging, advancing and/or pushing means, and the advancing, dragging or pushing force limitation  
20 takes place by exceeding the frictional junction force.

11. A method as claimed in one or more of the preceding claims, characterized in that the compression pressure of the pipe (5) against the dripping elements (4) downstream from the first contact area acts outside  
25 the pipe (5), whereas the dripping elements are supported by abutment means (3).

12. A method as claimed in claim 11, characterized in that the external pressure is exerted by stationary means, i.e. means at least having surfaces of contact  
30 with the pipe (5) which are stationary with respect to

the advance motion of the pipe (5), and said means being adjustable with respect to their pressure force.

13. A method as claimed in claim 11, characterized in that the external pressure is exerted by means which  
5 passively accompany the advance motion of the pipe (5), i.e. by means having contact surfaces which may be moved according to the advance of the pipe (5).

14. A method as claimed in claim 11, characterized in that the external pressure is exerted by means which  
10 are driven by their own motion in a direction corresponding to the advance direction of the pipe (5), i.e. by means having at least one surface of contact with the pipe (5) which is driven so that it may be moved in the advance direction of the pipe (5), and  
15 exerting at the same time a dragging action on the pipe (5).

15. A method as claimed in one or more of the preceding claims, characterized in that the pressure is exerted substantially perpendicularly to the surface of  
20 the pipe (5) and/or of the dripping elements (4).

16. A method as claimed in one or more of the preceding claims, characterized in that the dripping elements (4) are supported by stationary slide  
abutments in the compression area, that is by surfaces  
25 which are stationary with respect to the advance motion thereof.

17. A method as claimed in one or more of the preceding claims, characterized in that the dripping elements (4) are supported by abutments which passively  
30 accompany the advance motion of the dripping elements

(4) with the pipe (5).

18. A method as claimed in one or more of the preceding claims, characterized in that the dripping elements (4) are supported by abutments which actively  
5 accompany the advance motion of the dripping elements (4) with the pipe (5), being themselves driven by their own motion in the same direction as the advance direction of the dripping elements (4) with the pipe (5).

10 19. A method as claimed in one or more of the preceding claims, characterized in that the driving speed of the external presser means and/or of the internal abutments for the dripping elements (4) in the same direction as the advance direction of the pipe (5)  
15 is adjustable.

20. A method as claimed in one or more of the preceding claims, characterized in that the orientation of the dripping elements (4) and of the pipe (5) in the compression length is such that the two parts are  
20 parallel at least by their contact surfaces.

21. A method as claimed in one or more of the preceding claims, characterized in that the initial contact area between the dripping elements (4) and the pipe (5) and/or the compression length are provided in  
25 a conical narrowed length of the pipe.

22. A method as claimed in one or more of the preceding claims, characterized in that the dripping elements (4) are advanced on the feed path (3) continuously and consecutively, the distance between  
30 the individual dripping elements (4) on the feed path

(3) being greater than the distance between said dripping elements (4) when they are applied to the pipe, to an extent related to the difference between the speeds of the extruded pipe (5) and of the dripping elements (4).

23. A method as claimed in one or more of the preceding claims 1 to 22, characterized in that the dripping elements are advanced in a reciprocating stick-slip motion, there being provided a start station wherein each dripping element is kept still or anyway moved at a speed which is lower than or equal to that of the pipe and wherefrom said dripping element (4) is accelerated in the direction of the area of contact with the pipe (5) separately and directly or by successive dripping elements (4), arranged in a line in mutual contact, the acceleration action being exerted on the first dripping element (4) of the line at the rear end thereof with reference to the advance direction of the dripping elements (4).

24. A plant for implementing the method as claimed in one or more of the preceding claims 1 to 23, characterized in that said plant comprises:

- a) Means (1) for extruding a plastic pipe (5), through an extruding head;
- b) Calibrating means (6, 7) for progressively reducing the pipe (5) from the diameter coming out of the extruding head (1) to a final diameter along which reduction, the extruded pipe has a conical length.
- c) Feeding means (3) for inserting consecutively a plurality of dripping elements (4), and keeping pace

with the advance of the extruded pipe (5), through the extruding head (1) and into the extruded pipe (5);

- 5 d) Conveying and/or pushing and/or dragging means (103, 11) for feeding each dripping element (4) to the area of the pipe whereat each dripping element (4) is brought to contact with a predetermined area of the inner surface of the pipe (5), while having a predetermined speed with respect to the speed of the  
10 pipe (5) when contact occurs;
- e) Said speed of the dripping elements is selected as higher than the speed of the pipe (5) at least when contact occurs.

25. A plant as claimed in claim 24, characterized in  
15 that the means for advancing, dragging and/or pushing the dripping elements (4) are driven in such a way as to cause an impact of the dripping elements against the pipe which is meant to impress a mark in the contact area of the inner surface of the pipe (5).

20 26. A plant as claimed in claims 24 or 25, characterized in that it comprises means (3) for guiding the dripping elements (4), consisting of a stationary slide surface.

25 27. A plant as claimed in claims 24 or 25, characterized in that it comprises means (3, 103) for guiding the dripping elements (4), consisting of surfaces which are passively moved together with said dripping elements (4) or of rolling surfaces.

30 28. A plant as claimed in claims 24 or 25, characterized in that the guide means (3, 103) act, at



the same time, as means for dragging, advancing and/or pushing the dripping elements (4), being provided with surfaces for bearing the dripping elements (4), which are driven by a motion having the same direction as the advance direction of said dripping elements (4) inside the pipe (5).

29. A plant as claimed in one or more of the preceding claims 24 to 28, characterized in that the dragging, advancing and/or pushing means exert their action for a predetermined length even after the first contact between the dripping elements (4) and the pipe (5) has occurred, the means for guiding them (3, 103) extending also beyond the area of first contact with the pipe (5).

30. A plant as claimed in one or more of the preceding claims 24 to 29, characterized in that, in the area situated downstream from the area of first contact between the dripping elements (4) and the pipe (5), the dragging, advancing and/or pushing means are driven in the same way as in the area situated upstream from the area of first contact between the dripping elements (4) and the pipe (5), i.e. in such a way as to give the dripping elements (4) a speed which is higher than that of the pipe (5), whereas there are provided means for disengaging said dragging, advancing and/or pushing means from their respective dripping elements (4), in the area situated downstream from the area of first contact with the pipe (5), when a predetermined thrust thereof against the pipe (5) is attained, due to the different advance speeds.

31. A plant as claimed in claim 30, characterized in that the disengagement is obtained thanks to elastic means for damping the force for dragging, advancing and/or pushing the dripping elements (4) or thanks to friction means.

32. A plant as claimed in one or more of the preceding claims 24 to 31, characterized in that, in the area situated downstream from the first contact between the dripping elements (4) and the pipe (5), there are provided presser means (11, 11', 11''), outside the pipe (5), which are stressed by an adjustable compression force having at least one component perpendicular to the wall of the pipe (5).

33. A plant as claimed in one or more of the preceding claims 24 to 32, characterized in that the pressure means consist of a stationary presser means (11), i.e. a means at least having surfaces of contact with the pipe (5) which are stationary with respect to the advance motion of the pipe (5).

34. A plant as claimed in one or more of the preceding claims 24 to 32, characterized in that the presser means have a contact surface which passively accompanies the advance motion of the pipe (5), or a surface which is meant to roll thereon.

35. A plant as claimed in one or more of the preceding claims 24 to 32, characterized in that the presser means have one surface of contact with the pipe (5) which is driven by its own motion in the advance direction of the pipe (5), and which exerts a pushing and/or dragging action on the pipe (5) in the advance

direction.

36. A plant as claimed in one or more of the preceding claims 24 to 35, characterized in that at least in the area of first contact between the dripping  
5 elements (4) and the inner surface of the pipe (5), the profile of the pipe (5) and the path of the dripping elements converge.

37. A plant as claimed in one or more of the preceding claims 24 to 36, characterized in that in the  
10 area wherein the dripping elements (4) are compressed against the pipe (5), downstream from the area of first contact between said two parts, the profile of the pipe (5), i.e. of its wall, and the path of the dripping  
elements (4) are parallel or possibly slightly  
15 convergent.

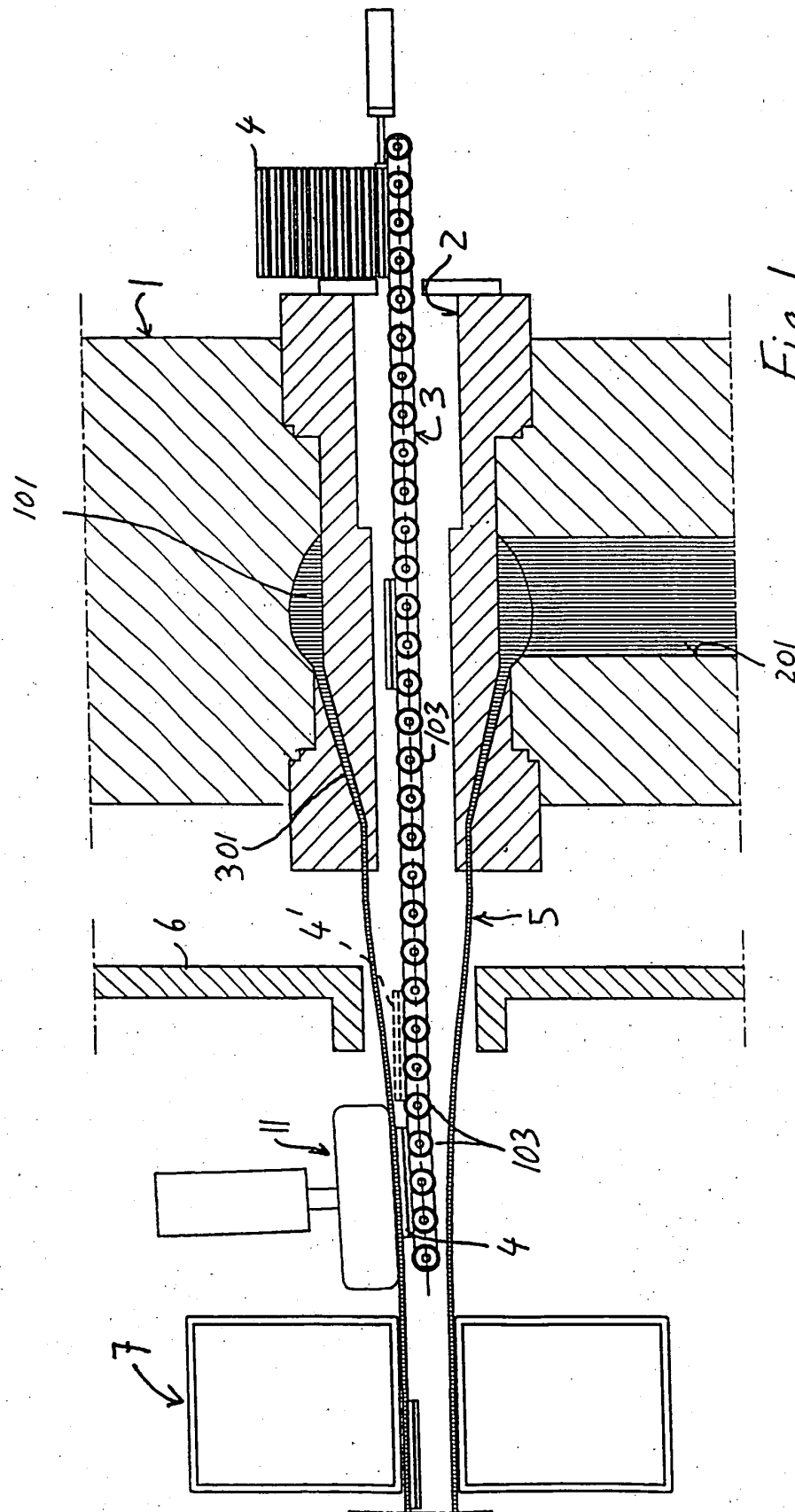
38. A plant as claimed in one or more of the preceding claims 24 to 37, characterized in that the first contact area is provided downstream from a first wall having the function to narrow the pipe (5) from  
20 the diameter coming out of the extruder to a first smaller diameter, and upstream from a succeeding intermediate or final calibrator for further narrowing the pipe (5) to a further intermediate smaller diameter or to the final smaller diameter.

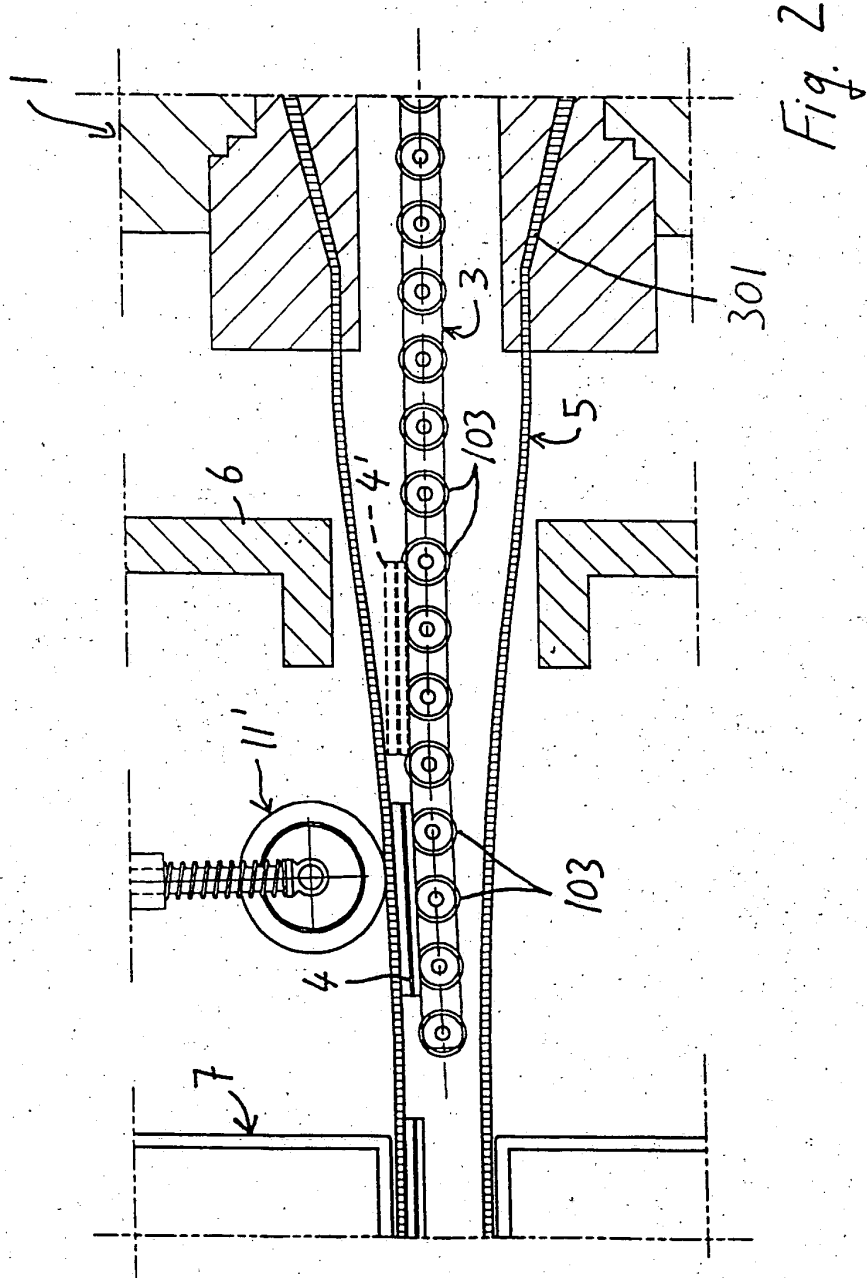
25 39. A plant as claimed in claim 38, characterized in that the first contact area and/or the area wherein the dripping elements (4) with the pipe (5) are compressed are provided in a conical length of the pipe (5).

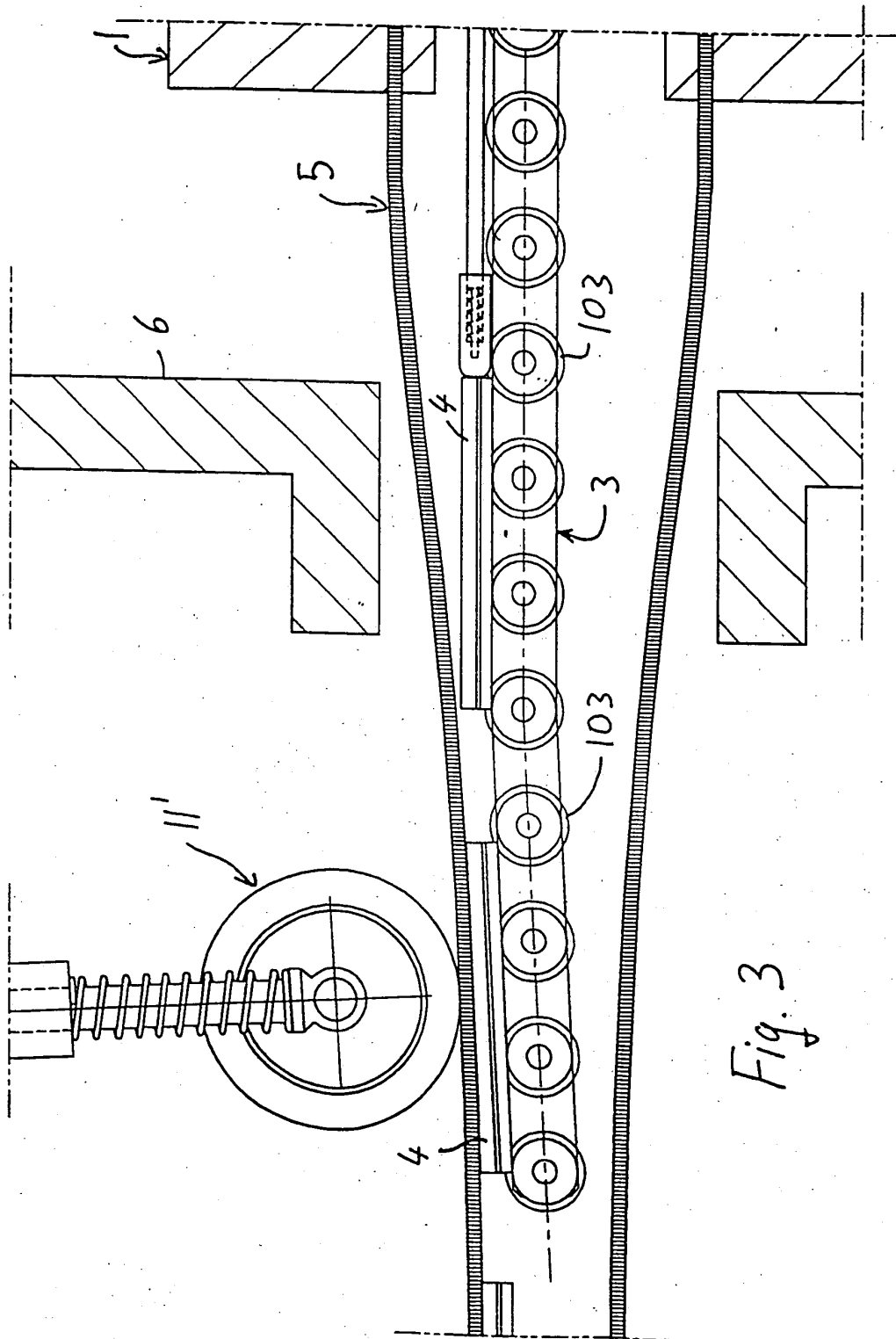
30 40. A plant as claimed in one or more of the preceding claims 24 to 39, characterized in that the

means for advancing, dragging or pushing the dripping elements (4) are of the continuous of reciprocating type.

41. A method and a plant for fabricating drip  
5 irrigation pipes, wholly or partially as described,  
illustrated and for the purposes stated herein.







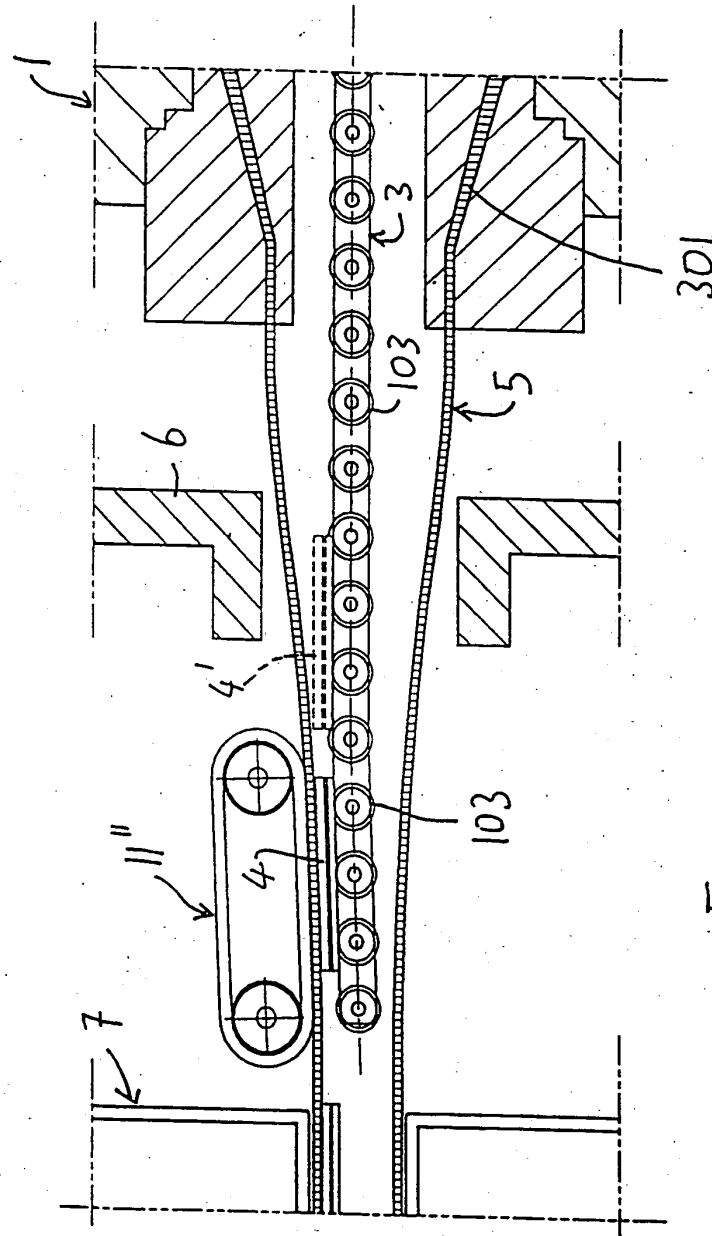
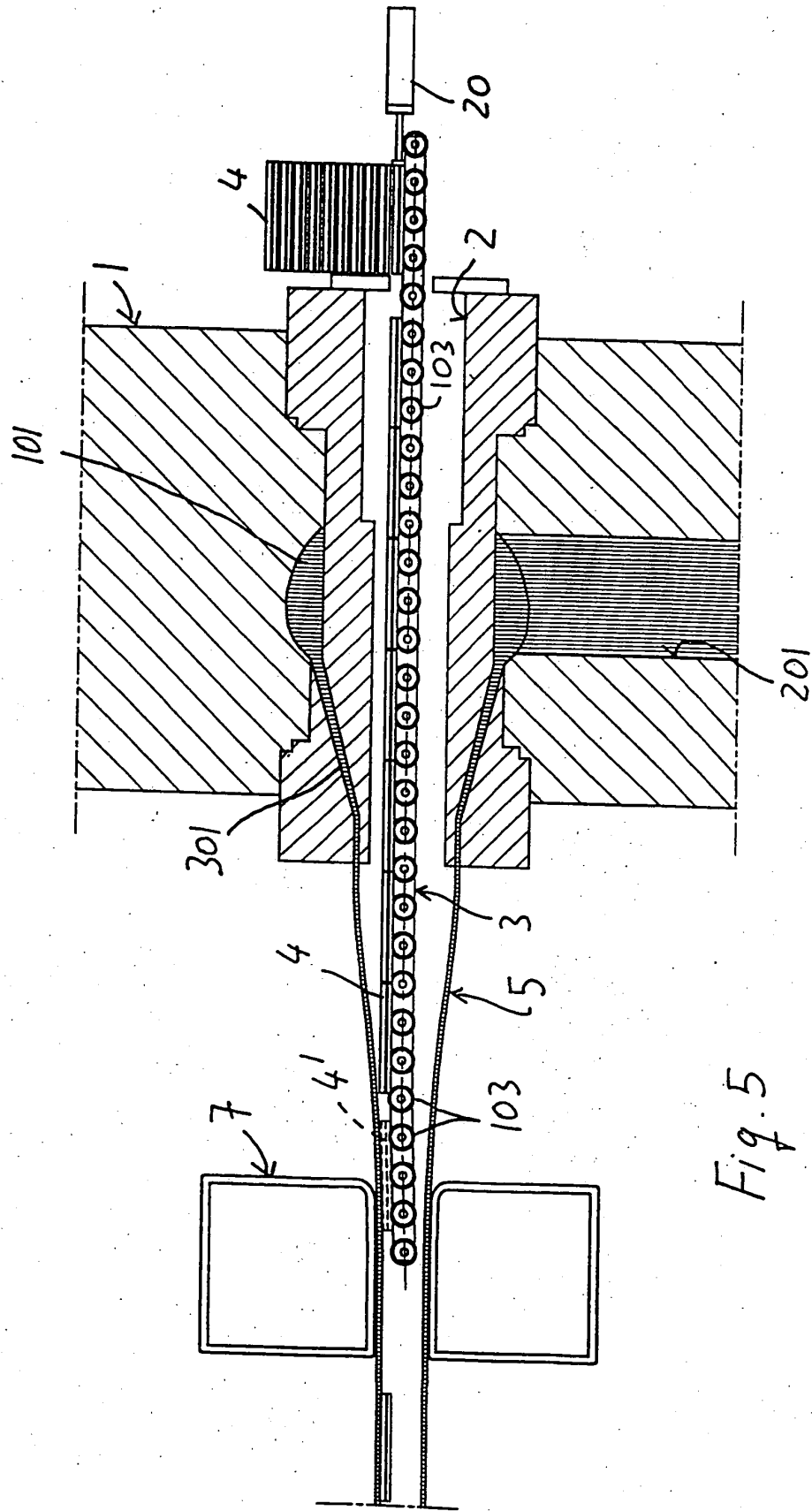


Fig. 4





# INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 99/05751

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A01G25/02 B29C47/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A01G B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	column 6, line 20 - column 7, line 25	3-8, 25, 26
A	claims 1, 3-10; figures	9-11, 16, 20-23, 29, 36, 37, 39, 40
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

16 December 1999

Date of mailing of the international search report

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 99/05751

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